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THE FALLACY OF COMMUNISM[1]

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It is trite to say that the world is in a state of revolution, but triteness is an evidence of truth. Since the end of the first World War this revolution has beset us with conflicting ideologies and perennial conflict. There was no time between the two great wars when the world was wholly at peace. Fascism developed in Italy, extended to Germany, and tried its arms in Ethiopia and in Spain. The military leaders of Japan encroached upon Manchuria and involved China in a long war. Communism entered the arena and grew to a commanding position in Russia, fostering a policy of expansion which made it a threat to many other countries.

Of these ideologies Communism alone remains secure. Fascist Italy, Nazi Germany and the militarism of Japan have been put down by force of arms at great cost in life and resources while our erstwhile allies, the Russians, continue to thwart our efforts toward lasting peace and in doing so arouse our suspicion that the Cominform is no more than the Comintern in disguise and that infiltration of Communism into other countries is still being actively and insidiously promoted.

Under these conditions the security of our American way of life is constantly threatened. England, our natural European ally, has swung to the left in name as well as in fact and we, without acknowledging it in the labels that we show to the world, have exhibited strong leftist tendencies. Does this modern trend mean that we have been softened for ultimate absorption into acknowledged Communism? Does the gradual change indicate a normal shift in human relations toward that end? Must Communism be accepted at last whether some of us like it or not? And finally, are those of us who dislike the implication merely reactionaries? Do we fight the change because we are selfishly interested in our own way of life and unwilling to change for the benefit of mankind, or have we actually in America, rather than only another political ideology, a sound way of living to defend?

This subject may seem a strange choice for a scientist, since it is a living issue in the newspapers and magazines of the modern world, and as far as the methods of the Soviets and of the Communist Party elsewhere are concerned, it is indeed unlikely grist for the mill of science. But the relations of living things, whether other organisms or men, are a normal part of biology and biology can offer sound and pertinent information even on the affairs of men. The variations of political emphasis are immaterial. That communism may be a form of government by communes or the strange Russian autocracy which calls itself truly democratic, that the stated principles of Karl Marx have been badly abused in the development of the communism of today, need not concern us while the central principle remains the regimentation of individuals and the elimination of private capital. From every man according to his ability, to every man according to his need, even though it is a communist credo, is a principle of social living so fine, so simple,

[1]Presidential address delivered before the Ohio Academy of Science, at the University of Toledo, Toledo, Ohio, May, 1948.

so basically sound and so amenable to scientific analysis that it is a sufficient point of departure.

That science has not contributed more to the understanding of man and of human society seems incredible. Possibly the failure is the fault of scientists, possibly of those who are more actively interested and more directly involved in the relations of men. In either case we may agree with Dr. Robert R. Williams who says in an article entitled *Natural Science and Social Problems:*[2] "In social problems there is no appeal to natural science, and natural science as such seeks no opportunity to be heard." The entire article is well worth reading for its penetrating analysis of the social ills of mankind and the need for scientific understanding and methods in the study of human relations, but we cannot consider it in detail for our more limited purpose. Let it suffice to note that in it we find encouragement and an intelligent plea for such an application of biological knowledge as is undertaken here.

Every college student who takes an introductory course in biology encounters facts which are significant in his own life and relations but probably few of them carry these facts beyond their immediate presentation in the textbook and laboratory. I wonder how many of their teachers do more? These facts begin with a fundamental property of living substance: organization. When the student makes the acquaintance of the cell he is confronted with a complex structure whose varied parts are beautifully shaped and beautifully coordinated for the maintenance of the entire unit, and there begins the relationship which continues so intricately through the animal kingdom to man himself.

The cell may be self-sufficient, but we see among the colonial Protozoa that these self-sufficient cells may, from some unknown cause, band together to live in groups and in some of these minute colonies we see further possibilities of such a close association. A division of labor occurs. Some cells assume one duty, others another, and the greater unit is maintained and perpetuated through their joint activities. We ascend to the sponges and there find such complexity of specialization that biologists were once in doubt whether they should be considered highly organized protozoan colonies or true multicellular animals, but when we reach the Metazoa there is no question. The existence of a nervous system in these animals knits the many parts of the body so closely together in their cooperative activities that we may even lose sight of the perfection of fitness of their many tissues and organs and organ systems for the special functions that they carry on unless our work deals with such matters. But the individual is still a unit which depends for its normal existence on that perfect organization.

But this is not all. As cells may be either independent individuals or units in a colony, so may multicellular animals, and as cells in the colony or in the multicellular body may be sharply differentiated for a division of labor, so may these more complex animals within their colonies. The marine coelenterates afford many examples of such colonies, structurally continuous yet composed of many individuals whose activities are coordinated for the maintenance and reproduction of the group.

Even though individuals may remain structurally discrete, this principle of organization extends still further into a phylum which stands at one of the pinnacles of evolution—the phylum Arthropoda. Here in the social insects we find it perfectly expressed. It is an object lesson by which we have failed to profit as we should even though comparisons have been drawn between the social organization of the insects and of man often enough from many points of view.

Two orders of insects, the order Isoptera including the termites and the order Hymenoptera including the ants, bees and wasps, contain species with complex

[2]Williams, Robert R., 1948. Natural Science and Social Problems, *American Scientist* 36(1), 116–126.

colonial organization. Their colonies differ in complexity and in permanence but at their maximum development they are very significant. In these colonies the individuals are not all alike. Their variation is not merely the variation of complex organisms such as we see in any species nor merely the differences of sex, but involves the existence of different castes, in the honey-bee colony the reproductive queen and drones and the sexually inactive workers, and in some other species a considerable diversity of forms which may bear little resemblance to each other. Individuals of each of these castes are shaped by heredity to carry on special functions and thereby to occupy a special niche in the colony. The coordination of their behavior is as nearly perfect as that of the component parts of the human body. They do not compete for individual advantage. As far as we know they do not quite their jobs nor strike for higher pay. They are utterly dependent on each other and if one caste fails in its duties all are ultimately doomed and the colony perishes. Each individual serves the colony according to its ability and each receives from the common stores whatever it needs.

Just as the varied functions of one body are carried on by its parts, so are the duties of the colony delegated to the special castes, and nowhere more conspicuously than in reproduction. The drone honey-bees have no value save to fecundate the queens. The queen has no value save to deposit eggs and, oddly enough, neither parent has any instinctive urge to care for its own young. Yet the workers, which have no instinct to mate and do not normally deposit eggs, carry on the elaborately specialized tasks of rearing the young.

This is a perfection of communal life which we can well envy. It has been appreciated for many centuries, as the search for a utopian organization of men attests. Plato's *Republic*, in the fourth century before Christ, outlines such a perfect communism. The scriptures emphasize its principles. And finally Sir Thomas More, almost five hundred years ago, coined the word Utopia for his organization of men which should coordinate them as perfectly for the maintenance of society as any social insects.

One fact these thinkers failed to note. Perhaps they should have been biologists first and philosophers later! That fact is simple. The true biological communism of the insect colony is an inherent pattern of life shared by only a few kinds of animals and man is not among them. When we consider the ways of the mammals, of which he is one species, we find that most of them are solitary, a term which means to the biologist only that the individual is a self-maintaining unit on which the species is based. Each individual defends himself and finds his own food and such shelter as he may need. He has only one need for association with others of his kind—the need for a mate when the second great urge of life is active. All individuals may mate and beget young and in the resulting family the intensely selfish motivation of their lives is at least temporarily modified.

This is the pattern of human life. Every human being is equipped by heredity with essentially the same structure as every other, barring the differences of sex. In the natural state each is self-sufficient and his motivation leads him to seek his own welfare first. Only in his family life is that motivation secondary. There nature has guaranteed the future of the species by shaping him to place the welfare of his dependents often ahead of his own. And since the long infancy of human beings results in the overlapping of a natural succession of children, the family becomes very nearly a lifelong preoccupation.

But even among the mammals a strongly gregarious tendency may develop. Man shares that tendency to a high degree and since he is an intelligent tool-making creature his association paves the way for a division of labor far more complex than that of any social insect and thus he has arrived at his intricate social way of life. But his division of labor is based primarily on special training. He remains a versatile being who may do many tasks well and who can become

discontented with his job or with his reward. To satisfy the inherent capacities which they do not satisfy he may want more than he can earn and in his search for satisfaction the natural allegiance to others which is basically expressed in his family may extend readily to his trade union, his village or his country, since their welfare and their security affect his own.

And man is pugnacious. The safety of the solitary animal demands that he be able to protect himself, but by some marvel of evolution that instinct has been directed in the social insects almost wholly to the defense of the colony. In man it is not so. He may fight his neighbor, he may fight for his union, and occasionally he fights magnificent wars, but the chip is still on his own shoulder whether it reveals itself in physical violence or in selfish diplomacy.

For these reasons the structure of human society rests on a foundation of quicksand. They explain our groping through the centuries for more nearly perfect relations among men. They explain the makeshifts and changes which promise so much and leave us in the end much as we were before. Citing Williams again, "we are doing no worse than in Roman times, merely no better." Man is simply not an inherently social animal and too many men fail to appreciate how they must behave as individuals to maintain a smoothly working society. They must be coerced by customs and laws and their inherent nature rebels at the coercion.

How, under such conditions, can man be communistic? Sir Thomas More regarded private property as the chief barrier to the attainment of his Utopia, as the basic reason for all of the lawless tendencies of men. He proposed a completely communal ownership of consumer's goods. Houses were not to be locked and freedom of entry was to be permitted. Every man might go to the centers of supply for the group and help himself to what he needed without making a direct return. The population was to eat in common dining halls in which the work was to be shared in rotation. Every human being was to work as long as he was able and then to continue into a happy and abundant old age. And his roseate plan extended into every detail of organization, freeing men from the established customs of his day as far as More could make the shift in his own mind.

It is a beautiful dream but we are still far from the utopian state for the simple reason that we are not utopian beings. Each of us is plagued by that versatility of the solitary animal. We conform to the social pattern by choosing a vocation and training ourselves to work at it, but once we have settled down to the routine of the job our unsatisfied urges clamor for expression, since few of us can express ourselves fully in one occupation. We need recreation, we cultivate hobbies, we seek entertainment which is usually a vicarious outlet for unfulfilled desires. Instead of finding the satisfaction of our biological needs adequate we work for the money and the leisure to secure in our avocations the expression of our latent capacities. And the individualism, or more bluntly the selfishness, of the solitary animal would result in our taking what we want far more freely than we do if the pressing need for restriction had not long ago imposed upon us the ethics and customs and laws that keep us within reasonable bounds of respect for the rights of others.

In the inherently communistic societies of insects these pressures are not felt. The individual is fitted by heredity for the performance of special tasks. Its structural adaptations and its mental patterns shape its course of life and it expresses its possibilities fully in the duties which it performs. It is not troubled by allegiance to its family, for even the process of reproduction is communal. The colony transcends the family and the individual as the multicellular body transcends the organs and tissues and cells which compose it. Both are maintained by the spontaneous coordinated activities of their subordinate parts and all of those parts share in the prosperity of the unit which they maintain. The

individual does not have unexpressed capacities to be satisfied, it need not interfere with the rights of others, and no government is needed to keep it in line with the common good.

Man, however, probably found in his initial division of labor intensely personal advantages. His heritage fitted him to do certain tasks better and more easily than others and he could devote himself more fully and more happily to the exercise of his own special aptitudes by exchanging his efforts for the products of similar specialization in others. If social life could have remained such a simple barter it might have greater possibilities of attaining communistic perfection, but unfortunately it could not. Our tool-making has led us into an extremely complex pattern of specialization in which the activities of men are often remote from basic needs and their desires often far surpass their productive capacities. Our intelligence, too, enables us to assess future values which cannot bring the immediate returns needed by individuals and so we need some planning and coordination and regulation for the ultimate good of the group. We secure these results by governing bodies of one kind or another and in this factor also our society draws away from true communism.

The desires of the individual, to be satisfied largely by the acquisition of property, and his need for direction, have led to the hierarchy of private and political managements expressed on the one hand in our capitalistic industrial system and on the other in our increasingly complex governments. Both have led to abuses and from both have come our communistic ideas and experiments, which should ideally lead to common ownership of all goods but those most intimately personal and to a perfect coordination of individuals which would result in anarchy because governments would no longer be needed. That end would be the final degree of social perfection, for true communism is nothing less.

But we must not forget the mold in which we are cast. Man, the solitary animal, does not spontaneously fit into a given niche in the social order. He works to satisfy his needs and his desires, and since they are in many cases greater than the value of his work to others, he may be discontented with his lot. He is shaped like other men and as a result he finds it difficult to understand why his rewards are less. Here is the source of more discontent and of antagonism to others as well. If his intelligence is high he may adjust himself happily to his lot but human intelligence varies and by the normal law of variation it is average or less in a majority of the population and as a result many men are discontented with the existing order and desirous of change. Their natural allegiance to family and to the smaller groups with which their own welfare is obviously linked enables them to use the power of numbers through pressure groups of all kinds to secure what they want for themselves and their dependents. The question of the greatest good for the greatest number does not necessarily enter. Instead society struggles along through a balance of power between labor and capital, between political parties and between national governments and alliances.

Political communism begins with the sound premise that these frictions should be eliminated. First, the accumulation of wealth must be prevented. Private capital must go. The government becomes ostensibly the people's government, its property is therefore theirs, and we are on the road to Utopia. For if the worker cannot be exploited by the capitalist there can be no abuse of individual privilege. In transition to anarchy some government is necessary and capital is always needed even though it is government capital, but if it is the people's own government that holds the power, then each man has a share in its efforts and in its gains and the abuses of the past are at an end.

Men worked toward this ideal through the evolution of their governments in the past. At first government depended on the might of a ruler and the inarticulate and illiterate masses submitted because they must. Then leaders arose

among them and over the route of the Magna Charta the common man gained some of the rights that he deserved and finally arrived at the democratic form of government so well developed in Switzerland and in the United States. Here every man who votes has a voice in the regulation of his own social group.

But the vote of the moron unfortunately carries the same weight as that of an intelligent man and the ruling majority may include far more men who are incapable of judging the issues at stake than intelligent voters simply because of the normal variation of mental capacity. And those less intelligent citizens are the ones most concerned with bettering their own lot and far less with their obligation to society. Any persuasive leader or attractive ideology that can promise them a more abundant life for less effort will gain their support. Hitler and Mussolini and the Russian leaders were persuasive and Fascism, Nazism and Communism appealed strongly to this class, for it has always been true that the support of an unthinking horde is needed to establish such revolutionary governments. The leaders of these movements are like other men. We have no reason to suppose that they are ideally interested in the welfare of their peoples to the exclusion of personal ambition and the thirst for power which are human expressions of the intense selfishness of the solitary animal. Enough of the people vote the new regime into power but only to find, tragically, that they have voted themselves into impotence and have reverted to a despotism probably little less than those which their ancestors fought to overthrow.

And so political communism is fallacious. Communal enterprises have worked on a small scale for fairly long periods, as in the Amana Society of Iowa, but Communism as we see it expressed today appears to be a bastard of the Fascist idea, the doctrines of Karl Marx, democratic principles of organization and dictatorial rule which seems removed only in outward form from actual despotism. But in any form communism is fallacious because of the biological nature of man. His retention of the characteristics of the solitary animals makes him an individualist. He demands self-expression. Yet he is an intelligent creature on the whole, who can see the value of the division of labor in his society. If he were so shaped that every man could spontaneously subordinate himself to the social group he might attain the semblance of communistic perfection but his selfish impulses are far more deeply rooted in his remote animal ancestry than his distinctively human qualities, and the more deeply rooted a tendency is in the evolution of an animal, the more spontaneously it is expressed. Perhaps, in the long course of our future evolution, the human species may become more fundamentally social. No evidence of such a trend can be seen at present, however, and certainly for a long time to come we must deal with man as he is today. What he needs for maximum social success is evidently a system of regulation which will guarantee him the necessities of life, enough opportunity for self expression to make him a happy contributing member of society and enough regimentation to bring this result as fully as possible to all men. But that is what the democracies have given him with a very reasonable degree of success, while Communism has accomplished far more in coercive regimentation than in opportunities for self expression.

Whatever man may do, since he is an organism, has a biological basis. His society is no exception. Because of this foundation man cannot be truly communistic. Any movement masquerading under that term is a wolf in sheep's clothing, for it promises what cannot be realized. The great theorists may have been honest in their ideals, but their biology was unsound. In the militant modern Communists we cannot even be sure of honest ideals, for the class antagonism that they preach is anything but true communism. But we are still fortunate in America, for the same biological foundation shows that our pride in our country is not based merely on patriotism nor on a selfish desire to perpetuate our own

comfortable way of life but on the fact that it is ultimately, biologically, a superb if imperfect example of the successful adjustment of solitary man to social living. We may support it as militantly as need be in all confidence that it is a sound way to the realization of the ultimate destiny of man, whether that destiny may be a true communism or merely a more effective compromise between human beings with the same inherent nature as those of today and the requirements of a sound social organization. More coined the term Utopia to designate a nonexistent land. It is still nonexistent. In spite of the lavish promises of Communism it cannot be created by deliberate planning. It is an inherent pattern of life developed in the social insects as the result of a long course of evolution which took place while our own species evolved toward a very different end. And evolution is immune from ideological and legislative influences.

Political communism can appeal strongly to men of limited intelligence since it promises them what they cannot earn for themselves. Through the power of franchise, if not of arms, they may force it upon increasing numbers of men, but the very need for force is a contradiction of true communism and an indictment of the existing political ideology. At the best it can only prolong our struggle for friendly cooperation among nations. At the worst it can plunge the world into a despotism such as men struggled for centuries to overthrow. For these reasons, but basically and insidiously because it is a contradiction of the inherent biological nature of men, the whole fabric of political communism is fallacious.

Until more men can understand the fundamental nature of this fallacy the threat hangs over us. And the hope that enough men can attain that understanding may itself be a utopian dream.

A NEW SPECIES OF ISSIDAE FROM CALIFORNIA

(HOMOPTERA: FULGOROIDEA)

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In the collection and study of the Homoptera occurring on grape in California two species of Fulgoroidea have been taken by Dr. Severin. One of these belonging to the genus *Hysteropterum* is apparently new and is being named in honor of Dr. Severin. He has furnished also the food plant data and collecting dates.

Hysteropterum severini n. sp.

Resembling *auroreum* (Uhler) but with flatter frons, longer elytra, and different male genitalia as noted in the description. Length, male, 4.5 mm.; female, 5.3 mm.

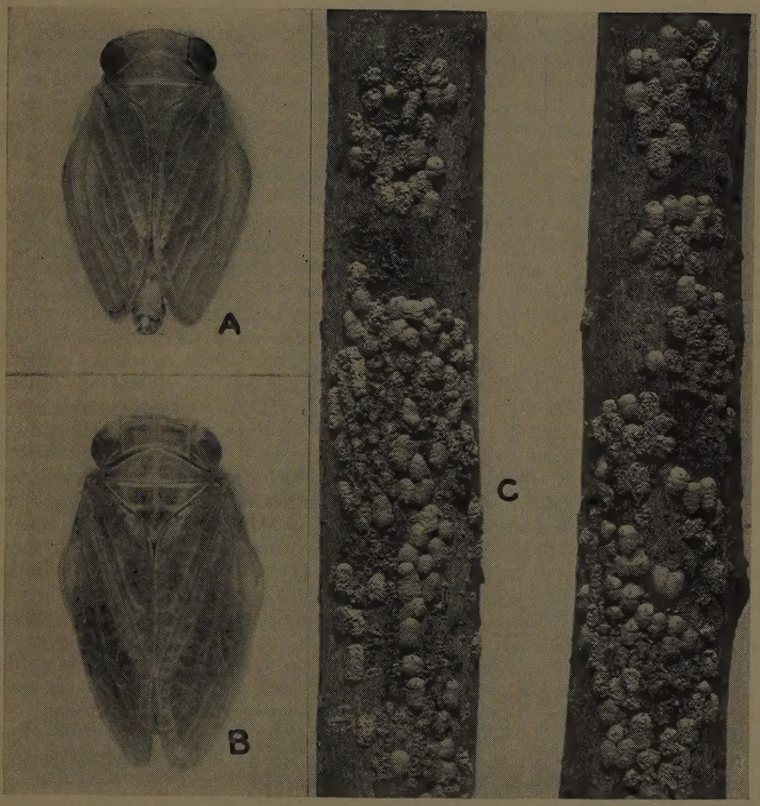
General color yellow to yellow-orange. Frons darkened between carinae. Elytra in female tending toward fuscous. Costal margin in both sexes broadly white.

Vertex three times as broad as long, quadrate, sharply carinate cephalad. Frons flat, without intermediate carinae. Clypeus scarcely protruding into frons. Elytra broadly bullate, longer than in *auroreum* (Uhler).

Anal segment of male bifid apically with lateral flaps projecting ventrad. Claspers with apical spur extremely elongate; heel narrow, half as long as apical spur. Aedeagus without apical spurs; ventral processes long, curved toward base of aedeagus with the extreme apices hooked dorsad.

Male holotype, female allotype, and paratypes of both sexes from Geyserville, Sonoma Co., California, collected on July 2, 1946, on California mugwort, *Artemesia vulgaris*, and on *Brickellia californica*. Paratypes were also common on olive trees and on coyote brush or chaparrol, *Baccharis pilularis*, July 2, 17 and 25, 1946, near Cloverdale, California, collected by H. H. P. Severin.

Dr. Severin also reports that egg masses were abundant on the trunks and branches of olive trees, occasionally on apple, plum, Oregon oak trees, *Quercus garryana*, and the poison oak, *Rhus diversilobia*, and on grapevines.



A—male, *H. severini* n. sp.; B—female specimen, same; C—eggs of same on branches of olive trees.

All photography by H. H. P. Severin.

MORAVIAN INFLUENCE ON INDIAN LIFE IN THE TUSCARAWAS MISSIONS, 1772 - 1777[1]

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By the middle of the 18th century, the Indians in the North American East had learned to realize that the white man's real intention was conquest of their territory itself, rather than concessions within it. By a shrewd alternation of military and diplomatic action they had been deprived of more and more of their ancestral hunting-grounds and arable fields. Belatedly aware that a timely alliance between the Iroquois and Algonquin nations might have expelled the intruders, they now saw that a gradual retreat toward the west was the only course open to the Indians, did they wish to maintain their national and tribal identities.

The Iroquois family of nations, who had long been bound together in a powerful federation, were less inclined to yield to the white pressure than were the Algonkian Indians in general, and the Lenni Lenapi, in particular, who had always been less politically minded and, therefore, less effectively organized than their more aggressive rivals. Eventually, the greater part of the Lenni Lenapi, better known as Delawares, left their land in the Delaware River basin and resettled on territory ceded to them by the Wyandottes. It roughly covered what is today the eastern half of the State of Ohio (1). Its boundaries ran, as follows: from the confluence of the Big Beaver with the Ohio up the Beaver and Mahoning Rivers; down the Cuyahoga to Lake Erie; then, along Lake Erie, westward to the mouth of the Sandusky; from there, in a generally southward direction, first to the headwaters of the Sandusky, and then, along a line slightly east of, and parallel with, the Olentangy and Scioto, to the headwaters of the Hocking River; down the Hocking to the Ohio; and finally up the Ohio, back to its confluence with the Big Beaver.

Among the part of the Lenni Lanapi nation, who had not left their old homeland, in the Delaware River basin, the Moravian Brotherhood had been successfully missionizing ever since the founding of the first Moravian settlements in Pennsylvania: Nazareth, in 1738; and Bethlehem, in 1741, even today the home of the Moravian Church in America (2). These two mission towns, and a few more, which had been settled and occupied by white brethren and sisters, attained permanence. Such mission towns, however, as had been built under the guidance of white Moravians by and for Indian converts, had eventually to be abandoned under the same political pressure that had previously driven about half of the Lenni Lenapi Nation into the forest lands across the Ohio River. First, the two mission posts on the Susquehanna, Friedenshütten and Schechschequanünk, had to be abandoned for Langundoutenünk (Friedensstadt), on the Beaver River (3); and shortly afterwards the converts and their Missionaries, from all three stations, again found themselves on the road to better promise; this time, to the Tuscarawas Valley, where the land for new settlements had been offered the Moravian missionaries and their flock of Indian converts by Netawatwes, the Great Chief of the Lenni Lenapi nation (4).

With the vision of a good ruler, Netawatwes had long realized the motivating force toward a better life, both economical and social, of morals such as taught in the gospel of Christ. Hence, he decided, with the consent of his Grand Council, to invite the Moravians to establish their teachings and mode of living among his

[1]Paper read before the Anthropology Section of the Ohio Academy of Science at the annual meeting, in May, 1948, at Toledo, Ohio. It summarizes part of the research work done by Dr. Mahr for The Ohio State Archaeological and Historical Society in connection with the restoration of the Moravian Mission town of Schönbrunn. The Society contemplates a detailed publication of these studies when completed.

Lenni Lenapi (5) whom he knew to be too undisciplined and unprincipled to withstand unaided the various temptations introduced by the white man. The worst of them, rum, had long been undermining the physical and moral resistance not only of his own people but of other Indians likewise (6).

In August, 1772, David Zeisberger, John Ettwein, and John Heckewaelder arrived in the Muskingum basin and forthwith laid out, on the Tuscarawas River, about two miles south of the present town of New Philadelphia, the village of Schönbrunn (7); and, in the same year, Gnadenhütten, 10 miles downstream from Schönbrunn (8). Through five years, these two settlements grew and prospered, both spiritually and economically, until, in 1777, they were seriously threatened by both of the conflicting parties engaged in the Revolutionary War, and had to be abandoned (9). In 1776, a third Indian mission town, named Lichtenau, had been founded in the immediate neighborhood of Netawatwes' capital (10), only to share the fate of Schönbrunn and Gnadenhütten a few years afterwards (11). It is an uncontested fact that the Lenni Lenapi chiefs did their utmost to keep neutral in the Revolutionary War (12), as well as they had in Dunmore's War, in 1774. In the latter conflict their War Captain, White Eyes, rather than Chief Netawatwes, had prevented the surging waves of Indian hatred from wiping out the Moravian mission towns and their Christian Indians together with the white teachers. True, it had been Netawatwes' initiative that had enabled the Moravians to settle in the Lenni Lenapi territory, but it was White Eyes' firmness of purpose and character that, in those days, not only averted a catastrophe (13) but also brought David Zeisberger's religious and political plan of "a Christian Indian state in the midst of the aboriginal domain" close to being realized (14). Its eventual failure was brought about, in the course of the Revolutionary War, by forces beyond the control of either the Lenni Lenapi Chiefs or the wisdom of Zeisberger. At the close of the war it was evident that the dynamic force of the white man's westward surge had forever sealed the fate of Zeisberger's and White Eyes' static concept of a Christian Indian state with legally guaranteed territorial boundaries (15).

About 1870, Edmund de Schweinitz, Zeisberger's Moravian biographer, wrote these lines:

> ". . . along the Tuscarawas and the Walhonding, the Muskingum, Hockhocking, and Scioto, not a solitary Indian lodge remains; from the waters of Lake Erie to the bluffs of the "Beautiful River," not a remnant of the Lenni Lenapi can be found. A great and teeming commonwealth of Americans is in the place of that home which White Eyes would have given to his people. Such was the will of God." (16).

This concluding phrase, coming from a true historian, is just another way of saying that the success of the Christian Indian state plan might have changed the entire course of history, not only on this continent but, indirectly, in Europe likewise.

Prior to his coming to the Muskingum basin Zeisberger had long acquired a profound insight into Indian life and mentality (17). It was in close co-operation with Bishop Ettwein, a remarkable organizer and executive, that the guiding principles for the Moravian mission work among the Lenni Lenapi were worked out (18).

As a foundation they laid down a code of statutes binding for all Indians who wished to live as Moravian Christians. If, after a period of probation, the applicants found that they could not meet the stipulations of these statutes; or, if the Missionaries saw, in the character of the applicant, certain flaws unlikely to disappear, residence in the Moravian community was denied (19).

This code contains 19 articles, some of which enjoin the Indians to do, or not to do, something which, in some respect, was foreign to them. Other articles lay

down, as binding rules, certain moral tenets which, previously, it had been at their choice to observe or to ignore. Others took care of ruinous habits acquired from contacts with whites, for instance, use of strong liquor, and unsound trading practices.

The first three of these articles are divine laws, corresponding to the first, third and fourth Commandments of the Decalogue; that is, exclusive worship of the One True God, and His incarnation in Jesus Christ; observance of the Lord's Day; and Honor to Father and Mother, with a pledge to provide for their old age. All three of these injunctions were new to the Lenni Lenapi who, like other Indian nations, had no concept of religious dogma, although they had held some hazy notions which, in part, had come to them from tribal tradition, but, in greater part, through much polluted channels, from old-time contacts with other missions, mainly Roman Catholic. Nor had they been under any direct obligation to support their old people although it was usually done (20).

Article 4 makes the reception into the Moravian community dependent on the consent of the Missionaries and an inquisition held by the Helpers.

Article 5 prohibits contacts with "thieves, murderers, whoremongers, adulterers, or drunkards." While, as a rule, the heathen Lenni Lenapi were not given to stealing, or murder, among themselves (21), they were highly promiscuous; committed adultery, with complete impunity for both men and women, married or unmarried (22); and reveled in alcoholic orgies that often involved an entire community, as it is attested by the Rev. David McClure, not a Moravian, on the occasion of his visit, in 1772, to Gekelemukpechünk, the capital of Netawatwes (23).

This native propensity to drunkenness caused the formulation, and relentless inforcement, of Article 13: "We will not admit rum or any other intoxicating liquor into our towns. If strangers or traders bring intoxicating liquor, the helpers shall take it form them, and not restore it until the owners are ready to leave the place." May it be said that the liquor traffic, to a great extent, was in the hands of Indian women (24) who, among numerous tribes, had the traditional right to sell, or trade off, most of what they or their husbands produced (25).

Intricately tied up with the drinking of the Lenni Lenapi were their "dances" as well as their "sacrifices, heathenish festivals or games," forbidden, for Christain Indians, by Article 6. Gambling, by means of peachstones used in the manner of dice, and also with imported playing-cards, was, next to drinking and sexual promiscuity, the most ruinous diversion of the Lenni Lenapi (26). These endemic vices were a matter of vital concern to some of the chiefs. Netawatwes repeatedly tried to stop the evil practices but never succeeded for any length of time (27).

The Lenni Lenapi were also notorious for the looseness of their marriage bonds (28). Polygamy, although rarely practiced as such (29), frequently resulted in cases where a husband, or wife, had become tired of their partner and had simply left to live with somebody else. The children then followed the mother since they were considered her property. Those who were grown up could follow the father if they so wished (30). Hence, Article 12 was formulated, as follows: "A man shall have but one wife—shall love her and provide for her and his children. A woman shall have but one husband, be obedient to him, care for her children, and be cleanly in all things." At times, the Mission authorities found themselves hard put to reconcile their converts' married status with the Christian view on matrimony. After lengthy debates among the authorities of the Moravian Church, at Bethlehem, Bishop Ettwein seems to have tacitly agreed that Indians who, at the time of their reception into the Christian community, had in good faith married two women, should love and honor both wives (31).

Since, in accordance with tribal custom, marriageable adolescents were free to marry whomever they wished, even against the will of their parents (32) article 16, of the code, commanded "young persons" not to "marry without the consent of their parents and the minister;" this rule was to prevent unbaptized persons from being brought into baptized families, and thus create confusion (33). Intermarriage

with white persons was in no way opposed; Bishop Ettwein, on the contrary, is on record for having recommended that a certain young missionary marry "a pretty Indian Sister," prior to his being placed in charge of a mission station (34). That the Lenni Lenapi had no race prejudice either is evident from cases where, in heathen communities, Negro slaves owned by Indians married within the tribe (35); and from other cases where Indian women, who generally were fond of white children, ran after white men until they had attained their purpose (36).

The last of the nineteen articles was adopted in later years, during the Revolutionary War (37). It commands the Christian Indians "not to go to war," nor to "buy anything of warriors which had been taken in war." It was the acid test of their religious faith, for it certainly took as much courage to forsake their warrior's status in the face of tribal derision, as it required on the part of the missionaries to make such a demand of Indian males. The amazing fact remains that the law was obeyed by the majority of the faithful.

One of the fatal shortcomings of the Indians and, particularly, the Lenni Lenapi, was their failure to decide upon a definite change from the life of the roaming hunter to the stationary existence of the farmer and cattle-raiser. Netawatwes and some of his councillors were well aware of the racial suicide forboded by such half-hearted wavering between the two economic principles (38). It seemed impossible to break the old habit of moving from one place to the other whenever their hunting grounds of the region became depleted, as each hunter shot from 50 to 150 deer a year; or merely, because fire-wood became scarce in the immediate neighborhood of their village (39). They simply left for another location, shiftlessly abandoning the corn crops their women had planted in the fields.

His desire to have the Moravian influence near at hand, and to make his people benefit from their example, was one of Netawatwes' principal motives for planting their missions in the Tuscarawas valley. Naturally, the missionaries were confronted with the same basic difficulties as was the Chief, but they succeeded where Netawatwes had failed, because they attacked the evil from its roots: faulty division of labor, and lack of any discipline whatsoever. Article 9 of the Moravian mission code reads, as follows: "We will obey our teachers and the helpers who are appointed to preserve order in our meetings, in the towns, and fields." The Missionaries had long realized that obedience was the primary requirement, if they expected the Indian men to do any work in the fields; chores, which theretofore had exclusively been done by the women. The men primarily were hunters and warriors; occasionally they put up a house or a fence, but everything else was left to the women, who tilled the soil; planted the seed; harvested the crops; gathered fire-wood; carried water; prepared the meals and sewed the clothing for the family; gathered the wild hemp for their making of carrying-girths; gathered rushes, along with the herbs and roots to dye them with; weaved the dyed rushes into mats; dressed deer-skins and made them into leggings and moccassins. On top of that, they bore the main labor load during the sugar-boiling season, in February and March, and were lucky if their husbands, in the predeeding winter months, had seen fit to carve enough wooden bowls and troughs to hold the maple-sap. Occasionally, a man would take a hand in keeping the sap from boiling over, while, as a rule, the men, during the sugar-season, were roaming the forests, hunting, in order to provide meat for immediate consumption, as well as for drying and storing it, to last through the summer.

John Heckewaelder, more objective than Zeisberger as a critic of Indian sociology, defends the Lenni Lenapi male against the opprobrium of shiftless loafing and pleasure-seeking. He argues that the women's "hard and difficult employments are periodical and of short duration, while their husbands' labors are constant and severe in the extreme." Since on the husband's "exertions as a hunter, their existence depends," "he must keep his limbs as supple as he can, he must avoid hard labor as much as possible." Hence, he cannot think of taking "upon himself

a part of his wife's duty, in addition to his own," or "he must necessarily sink under the load, and, of course, his family must suffer with him (40)."

Whatever the merits and demerits of the two sexes, they were the results of an unbalanced division of labor, typical of a transitional economy that no longer rested exclusively on hunting and gathering, but had not yet reached the full stage of farming and cattle raising.

It was the aim of the Moravian mission system to shift the economic balance of the Lenni Lenapi definitely to farming, by means of a well considered division of labor between men and women. The men were to restrict their hunting excursions to a minimum, both in extent and frequency (41), while the women's burden was to be lightened by making their former activities in the fields joint enterprises of both sexes, in the form of community labor (42). Community labor was also demanded of the men when public structures had to be put up, such as a church, or a school house, or fences around the town and fields; or when the increase of the convert population called for the building of a number of new houses. In such cases, the women as a group provided food for the men as a group (43). The missionaries gave much thought to the even spreading of labor and leisure over the hours of the day, as well as over the whole year. The real secret of their success was their wisely calculated long-term planning. They decided what had to be done, at what season of the year, and with how many workers available over how long a period (44). In order to assure the desired results, Article 17 was drawn up, as follows: "Whenever the stewards or helpers appoint a time to make fences or to perform other work for the public good, we will assist and do as we are bid."

There is no evidence from the mission reports that the local administration's economic efforts were ever frustrated by Indian reluctance to work, let alone, defiance. On the contrary, there are numerous entries testifying to both the excellent planning of community projects and their amazingly speedy completion (45).

One of the first things to be done, once that the site of a new mission station had been selected, was the laying out of the prospective town in the manner which the Moravians called "regular" and which they followed in all their settlements. The basic plan pattern is the same in every Moravian mission town: namely, an aligning of the houses, along cross streets, in town blocks of equal size, symmetrically arranged right and left of a main street functioning as the symmetry axis, with the Church on a key point of the symmetry system.

This was in fundamental contrast (as coercive as it was intentional) to the Lenni Lenapi's native notions of settlement. They had been in the habit of building their houses as close to, or as remote from, each other's as they chose; and of abandoning their lodgings whenever they had a mind to, and, with them, their cultivated fields, provided they had cared to cultivate any (46). Those at Schönbrunn, Gnadenhütten, and the other missions, found themselves fitted in a framework of geometric boundaries, as equal parts of a structural unity, in both the physical and social sense; a structure, not merely tangibly static but also inspiringly dynamic, in that it almost automatically mobilized all its individual members for the service of the whole.

The plausibility of this system, and of the methods sustaining it, not only captivated the Indian converts living by it, but it also caught the imagination of those among the heathen Lenni Lenapi, who had eyes to see and ears to hear. They realized that the magic of form, such as embodied in Schönbrunn and Gnadenhütten, might merit acquisition by imitating its outer shape, so as to serve as an arcanum against the forces of evil, which were breaking up their national life from within. In 1775, the heathen Lenni Lenapi laid out for themselves a brand-new town on which Zeisberger comments in these words:

> "Their new town has been laid out and staked off in the form of a cross-street, lying along the Muskingum, the design having been copied from us. . . . Each tribe, clan and nation is to have its own street."

A few lines below he points out their faulty approach, as follows:

> "As they have much work and there are many people, who, however, hinder each other because they do not know how to portion out their tasks, our brethren, upon their request, gave them good advice and told them how we proceeded in our Towns, which pleased them so that they declared they would follow our example." (47).

Needless to say, the project failed miserably.

In order to assure a continued success of their mission plan, the missionaries paid great attention to a proper upbringing and adequate schooling of the converts' children (48). Schönbrunn and Gnadenhütten as well as the other mission towns had schools in which religion, reading, writing, and a little arithmetic were taught in the native language. The textbooks were the work of Zeisberger who completely mastered the Lenni Lenapi dialect; both he and Heckewaelder conducted the school at Schönbrunn (49). Regular attendance was demanded, and the parents, especially the mothers, were exhorted to train their children away from idleness (50). Since the girls had always been taught to work anyway, this admonition mainly applied to the boys who, under native conditions, were never urged to do anything they did not wish to do (51). In the training of their children, even the Christian Indians appear to have been rather negligent, for again and again new admonitions had to be issued to the parents to take better care of their children and keep them clean and busy.

In general, the missionaries interfered as little as possible with their converts' ancestral customs. Of course, certain habits in dress and ornamentation had to be curbed (52). Christian Indians were not expected to wear nose-rings; or grow a scalp-lock (53) and pluck out the rest of their hair; or to use body and face paint; or tattoo their faces and bodies (54); or hang silver ornaments in their hair, and silken ribbons on their clothing, as it was a fashion with the women, and to some extent also with the men. Such were heathenish customs "not suitable for church members," as Zeisberger puts it (55).

The range of this article does not permit to present more reasons why it is to be regretted, that the course of history had decided against Zeisberger's plan for a Central Christian Indian State.

Not in terms of regret but rather in the form of constructive, although belated, advice did Thomas Jefferson enjoin the Indian chiefs of his day, among them several Lenni Lenapi, in repeated letters, to ward off the extinction of their race by doing essentially what the Moravians had set out to teach them. In a letter, undated, but probably of 1808, to the Lenni Lenapi War Captain Hendrick, Jefferson wrote these words:

> ". . . if you wish to increase your numbers you must give up the deer and buffalo, live in peace, and cultivate the earth. You see then, my children, that it depends on yourselves alone to become a numerous and great people. Let me entreat you, therefore, on the lands now given you to begin to give every man a farm; let him enclose it, cultivate it, build a warm house on it, and when he dies, let it belong to his wife and children after him. Nothing is so easy as to learn to cultivate the earth; all your women understand it, and to make it easier, we are always ready to teach you how to make ploughs, hoes, and necessary utensils. If the men will take the labor of the earth from the women they will learn to spin and weave and to clothe their families. In this way you will also raise many children, you will double your numbers every twenty years, and soon fill the lands your friends have given you, and your children will never be tempted to sell the spot on which they have been born, raised, have labored and called

their own. When once you have property, you will want laws and magistrates to protect your property and persons, and to punish those among you who commit crimes. You will find that our laws are good for this purpose; you will wish to live under them, you will unite yourselves with us, join in our great councils and form one people with us, and we shall all be Americans; you will mix with us by marriage, your blood will run in our veins, and will spread with us over this great island." (56).

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NOTES

(1) *HH*, p. 84.
(2) *HN*, p. 113 f.
(3) *Ibid.*, p. 234 ff.
(4) *Ibid.*, p. 238 ff.
(5) *Ibid.*, p. 229.
(6) *McCD*, pp. 63–66; *HN*, p. 324.
(7) *HN*, p. 238 ff.
(8) *Ibid.*, p. 241 ff.
(9) *Ibid.*, p. 276.
(10) *Ibid.*, p. 261.
(11) *Ibid.*, p. 330.
(12) *HN*, chap. XVIII; *deSchZ*, chapters XXVII and XXVIII.
(13) *SD 7* (Feb.–May, 1774); *deSchZ*, pp. 413–419.
(14) *deSchZ*, p. 413.
(15) *Ibid.*, p. 419.
(16) *Ibid.*, p. 419.
(17) *Ibid.*, chapters VI–XX.
(18) *Ibid.*, chap. XXI.
(19) *HN*, p. 238 ff; *DeSchZ*, p. 378 f.
(20) *ZH*, p. 123 f.
(21) *Ibid.*, p. 123.
(22) *Ibid.*, p. 20 f.
(23) *McCD*, pp. 73–80.
(24) *ZH*, p. 117.
(25) *Ibid.*, p. 16; HH, p. 158.
(26) *Ibid.*, p. 118 f.
(27) *Ibid.*, p. 117.
(28) *Ibid.*, pp. 20 f., 82 f.
(29) *Ibid.*, p. 81.
(30) *Ibid.*, p. 99.
(31) *HJE*, p. 107.
(32) *ZH*, p. 79.
(33) *HJE*, p. 109.
(34) *Ibid.*, p. 105 & n.
(35) *ZH*, p. 124.
(36) *Ibid.*, p. 141.
(37) *HN*, p. 240.
(38) *SD 1* (May 7, 1772).
(39) *ZH*, pp. 14, 87.
(40) *HH*, chap. XVI.
(41) *ZH*, p. 14.
(42) *SD 11* (June 16, 1775), *GnD* (June 15, 1773), *et al.*
(43) *GnD* (Aug. 23, 1773).
(44) *SD 3* (Jan. 24, 1773); *SD 7* (April 11, 1774).
(45) *GnD* (Aug.–Sep., 1773); *SD 5* (Sep.–Oct., 1773).
(46) *ZH*, p. 87.
(47) *SD 10* (April 7, 1775).
(48) *HJE*, p. 113; *SD 3* (Dec. 22, 1772); *et al.*
(49) *ConfMin* (Aug. 17, 1772); *SD 12* (Dec. 4, 1775).
(50) *SD 10* (April 27, 1775).
(51) *ZH*, p. 16.
(52) *SD 12* (Jan. 15, 1776).
(53) *TMHS*, Vol. I, p. 349.
(54) *HH*, p. 206.
(55) See note (52).
(56) *CJ*, p. 503.

MISSISSIPPIAN DISCONFORMITY AND COMPACTION

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One of the best examples of a disconformity in Ohio is displayed in a railroad cut about one-half mile northeast of Marshallville in Chippewa Township. This disconformity has been mentioned by Conrey.[1] The outcrop shows a horizontal mass of Mississippian sandstone of the Waverly series, and above it and dipping away from it on all sides, the lower portion of the Pottsville formation of the Pennsylvanian system. What formation of the Waverly series is represented in the exposure has not been satisfactorily determined. It is probably the Logan sandstone formation. It is believed by some geologists that the member may be the Black Hand sandstone of the Cuyahoga formation. The thick-bedded sandstone with occasional thin beds of shale resembles to some degree the Black Hand sandstone in its northerly extension in Ohio.

The Pottsville formation in the exposures near Marshallville consists of rather coarse-grained sandstone with occasional small white quartz pebbles from one-eighth to one-half inch in diameter. It is not as conglomeratic as is usual of the basal Pottsville. The jointing is irregular and varies in color from gray to yellow to red. It contains the carbonaceous remains of plants. The basal sandstone grades upward into coal-black laminated shales containing concretions. In this shale are occasional sandy strata. Glacial till covers the entire area.

As one walks along the railroad in a northeasterly direction from Marshallville, the first buried hill makes its appearance. Here the massive sandstone beds of the Waverly are flanked for the most part by shale and some sandstone strata which dip away in all directions, at first steeply and diminishing with distance. Farther on, the basal beds of the Pottsville rise to form an arch which appears above the track level in the cut. The buried hill of Waverly sandstone is not exposed but the evidence of its existence is indicated by the dome-like structure of the basal Pottsville. Farther on, the railroad cuts across the top of the largest of the buried sandstone hills (Figs. 1 and 2). The Pottsville beds dip away in all directions, first steeply and gradually flattening out with distance and ultimately becoming horizontal.

Before the advent of the glaciers in Pleistocene time, the Pennsylvanian formations were eroded from the top of the buried hills but were preserved in the basins between.

In the long interval which elapsed after the Mississippian beds were laid down a great amount of erosion must have taken place. Over a large part of Ohio, the upper Mississippian was completely removed and in the northeastern part of the state, a large part of the Waverly series of lower Mississippian age was eroded. In some places in northeastern Ohio, so much of the Waverly series was eroded that the basal Pottsville beds lie not far above the Berea sandstone. Throughout Ohio and beyond there is evidence of widespread erosion following the Mississippian and prior to the deposition of the Pennsylvanian formations.

A study of the exposures near Marshallville indicates that the Mississippian sandstone was weathered during the interval represented by the disconformity. Incorporated in the beds at the base of the Pottsville formation are sandstone fragments derived from the Waverly sandstone. These are angular for the most part but show the effects of having been moved by waves and currents. The

[1]Conrey, G. W., Geology of Wayne County, Geological Survey of Ohio, Bulletin 24, 1924, page 92.

contact between the Pottsville and Waverly is sharp. The basal Pottsville shales and sandstone flatten out where they project over the top of the buried hill.

It is evident that a rough topography resulted from the erosion of the Mississippian formations before the advent of the Pottsville sea. A hilly topography was invaded by an encroaching Pennsylvanian sea. That the hills were buried beneath Pennsylvanian sediments and not removed by wave and current erosion may indicate that the land sank at such a rate that marine erosion did not have time to bevel the surface.

FIG. 1. A buried hill composed of horizontally lying Waverly sandstone and the inclined, overlapping Pottsville strata. Note the decrease in dip of the Pottsville beds from the hill.

The irregularity of the contact between the Mississippian and Pennsylvanian systems can be appreciated when the variation in elevation of the contact is obtained over large areas. In places, differences of more than 150 feet or more occur within short distances. At one locality in Wayne County the contact is 1060 feet above sea level and five and one-half miles to the southwest the conglomerate in the Pottsville formation at the base of the Pennsylvanian rests on

the Waverly surface at an elevation of 880 feet above tide. Many other striking illustrations of the magnitude of this unconformity in Ohio could be given. As the Pennsylvanian seas covered the rough Waverly surface, the oldest members of the Pennsylvanian system were deposited in basins and channels.

According to Twenhofel,[2] deformation caused by compaction results from the settling of sediments over any rigid body. This may be a buried hill, a reef or a sand or gravel lens. Compaction arises from the expulsion of water, closer packing or new combinations of sediments. It is believed to be negligible in sands and

FIG. 2. Section of the Waverly sandstone. The entire width of the exposure in the railroad cut is about 300 feet.

coarser clastics and is most important in fine-grained sediments such as clays, silts and calcareous muds. Some marls and clays are composed of as much as 70% water and many fine-grained sediments contain more than 50%. Much of this water is expelled with a corresponding reduction in volume. Compaction due to

[2]Twenhofel, W. H., Principles of Sedimentation, pp. 532-533.

crystallization and packing is also noteworthy. However, the expulsion of water is by far the most important factor. Fine-grained sediments deposited over and around reefs and lenses of sand or coarse clastics may experience compaction of 50% or more. Strata passing over the non-compactible Waverly sandstone hills would become arched into domes and anticlines, depending on the slopes of the buried features.

The fine-grained sediments would be washed from the high places into the basins. There can be subaqueous sliding from the steeper slopes into the basins. Twenhofel points out that compaction and settling proceed simultaneously with deposition, maintaining some slope until the high places have been completely buried and the overlying formations could be warped through considerable thicknesses. The buried hill or rigid body could thus be reflected through considerable thicknesses of sediment as folds or domes.

The buried Waverly surface with its hills would be favorable for the development of structures of compaction origin. They have been noted in the mid-continent and other regions in the drilling for oil. The marked dip of the Pottsville beds in all directions from the buried hills and the dome and anticlinal structure above them may be accounted for by compaction.

GUANIDINE FERRIDEHEMOGLOBIN AND THE CARBIMID STRUCTURE OF "CYANAMIDE"

The Relationship of Chemical Structure to Cholinergic Activity

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The capability of combination of ferrihemoglobin with the majority of known hydroacid anions suggested that this type of combination was due to the comparatively small ionic diameter of the latter with their consequent ability to penetrate the interstices of the porphyrin ring and come within sufficient proximity of the 3^2 electronic orbit of the iron atom to permit polar covalent combination.[1,2,3] This capacity would be facilitated by a distortion of the octahedral iron-porphyrin lattice whereby at least one of these interstices is widened. Such a lattice distortion for ferrihemoglobin has been postulated by Coryell and Stitt[4] who regard combinations of the ferrideheme type as exemplifying a heptacovalency of the iron. Since ferrideheme combinations of ferriheme and the ferrihemochromogens are rare while those of ferrihemoglobin are frequent, it is reasonable to assume a lattice distoration in the last case through its iminazolyl coordination[5] (Fig. 2). Heptacovalency would then account for combination with any of the ordinary anions. This, however, does not occur; ferrideheme formation potentiality is limited to a specific group; the hydroacid anions. With the discovery of O-benzoic sulfinide ferridehemoglobin[2]—the anion in this case being relatively large—it became apparent that size of the hydroacid anion was not the conditioning factor and search was made for other chemical common property characteristics of this class of anions. Stereochemical representation of the O-benzoic sulfinide radicle showed an acute polar tenaille. Since an acute tenaille would permit approximation of the polar group to the 3^2 orbit of the iron, the other ferridedheme formers were examined in this regard. Acute polar tenailles were demonstrable for all with the single exception of cyanamide as depicted by the ordinarily ascribed carbamonitrile configuration (Fig. 3).

However this configuration is at variance with the low dipole moment of cyanamide ($\mu_{20^\circ C} = 3.8$ D)[6] and the Raman spectrum suggests that some of the material in solution is in the carbimid form.[7] This form, rendered in Fig. 4 is isosteric with carbon dioxide and its ionized form would have two acute tenailles. Such a representation, if correct, would indicate that cyanamide is an anammonide of guanidine rather than (as the carbamonitrile) an anhydride of urea. There are some physiologic and pharmacologic bases for regarding the former relationship to exist. (1) Administration of arginine to cystinuric individuals results in the excretion of cyanamide.] (2) Cyanamide is available for the *in vitro* synthesis of creatinine.[9] (3) Cyanamide and guanidine are both cholinergic drugs; the fibrillary somatic twitching of cyanamide intoxication being abolished by atropine[10] as is the same feature of guanidine poisoning.[11] Because of the definitely close pharmacologic, and a possible chemical relationship of the two substances one might anticipate ferrideheme formation on the part of a solution of guanidine the aresonant form of which has an acute polar tenaille (the ionizable imino group). But since the bulk of such a solution would consist of the resonating guanidinium ion[12] a large molar excess should be necessary to demonstrate such combination.

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EXPERIMENTAL

Ferrihemoglobin solutions were prepared by the treatment of laked, washed human erythrocytes with (A) ferricyanide solution, (B) azochloramide or (C) saturated aqueous iodine. All pigment solutions were then diluted to a ferrihemoglobin concentration of 0.4 millimolar. Samples of each solution were brought

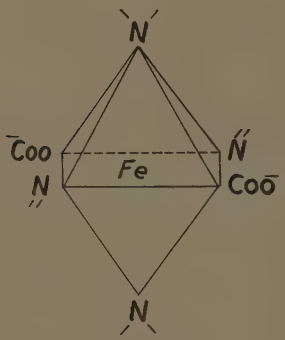

FIG. 1

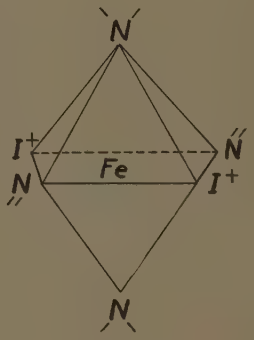

FIG. 2

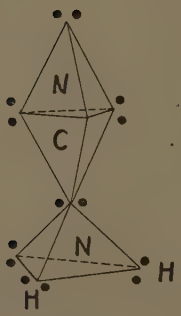

FIG. 3

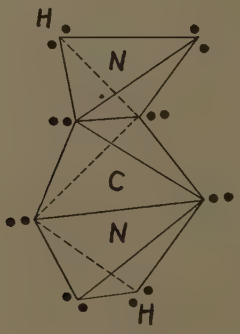

FIG. 4

FIG. 1. Stereochemical representation of axially symmetric octohedral hexagonal ferriheme pattern in which the carboxyls are coordinated in the 4° electronic orbit of the iron without distortion of the porphyrin lattice.

FIG. 2. Asymmetric porphyrin lattice of ferrihemoglobin. Distortion of one or more of the octohedral facets is brought about by coordination with the quarternary iminazolyl nitrogen of the globin histidine. By this agency one or more interstices in the 4° coordination shell is widened permitting polar covalent linkage with the iron in the 3^2 electronic orbit by anions or negative radicles with an acute polar tenaille.

FIG. 3. Carbamonitrile structure of cyanamide showing two obtuse polar tenailles on the same nitrogen atom. For purposes of representation in this and Fig. 4, the molecule is depicted in its undissociated state; the tenailles being in polar covalency with hydrogen.

FIG. 4. Carbimid structure of cyanamide; a symmetrical molecule with two acute polar tenailles each of which is on a separate nitrogen atom.

to varying guanidine concentrations ranging from 0.1 to 2.0 Molar by the addition of guanidine hydrochloride. After various intervals the reaction mixtures were subjected to spectroscopic examination.

Concentrations of guanidine less than 0.3 M are without effect on the color or spectroscopic features of ferrihemoglobin solution. Concentrations between 0.3 and 1 M produce a gradual color change from brownish to scarlet and the ferrihemoglobin absorption band in the red region of the spectrum is replaced by a diffuse single band with indefinite limits ranging from about 5400 to 5900 A°.

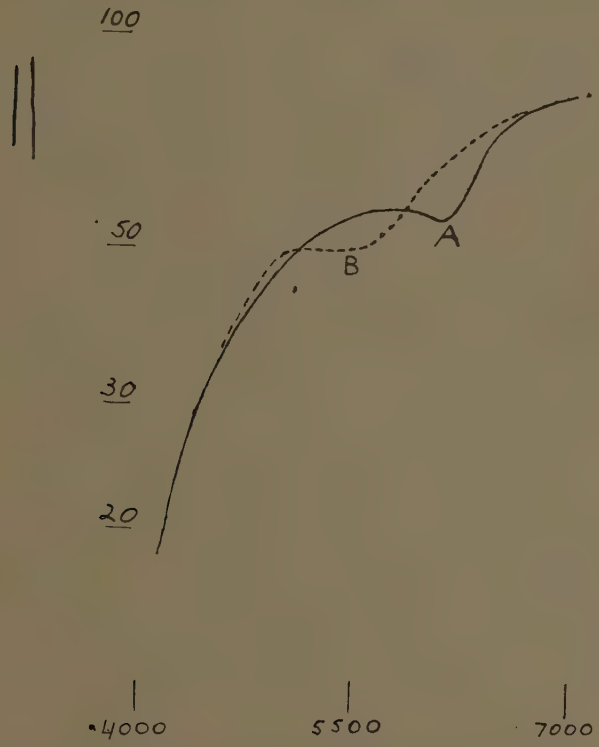

FIG. 5. The Effect of Sulfhydryl on the Spectrophotometric Absorption Curve of Lithium Ferriheme. The ordinates represent percentage transmissions and the abcissae, wavelength in decimicrons. Curve A shows the absorption of lithium ferriheme solution while curve B shows the absortion of an identical solution containing a molar equivalent of cysteine. The shift in spectral absorption which accompanies ferrideheme formation is qualitatively similar to that caused by the addition of guanidine or cyanamide to ferriheme and the direction and magnitude of this shift is best explained on the basis of polar covalent combination in the 3^2 electronic orbit of the iron. Such inner orbital covalency may be an example of a theoretically possible interorbital type of resonating structure.

(This is the region in which all of the ferridehemoglobins exhibit their single absorption band). Guanidine concentrations above 1 M cause a rapid but evanescent appearance of this band after which denaturation occurs. Apparently guanidine reacts with ferrihemoglobin in a twofold manner; by ferrihemoglobin formation and

denaturation, the former being a zone reaction because of the intrusion of the latter. By stratification of a 0.4 M ferrihemoglobin solution upon a saturated guanidine hydrochloride solution in a test tube, a ring color reaction gradually develops within the ferrihemoglobin stratum and at the time of its greatest clarity and breadth (about 10 hours after stratification) is amenable to spectroscopic examination, upon which it is found to be practically indistinguishable from cyanamide ferridehemoglobin.

The experiments were controlled by testing the effect of guanidine on the pH of ferrihemoglobin solutions. This was deemed advisable even though the colored reaction product bore no spectroscopic resemblance to ferrihemoglobin hydroxide because the similarity of the guanidine and cyanamide-ferrihemoglobin reaction products might give rise to the suspicion that guanidine was converted to cyanamide during the course of the reaction. While the possibility of such a conversion is highly remote in this instance (on purely chemical grounds) it is ruled out by the absence of pH change in the reaction mixture as any such change must be accompanied by the liberation of ammonia. Cyanamide in 5 Molar concentration does not denature ferrihemoglobin while denaturation is evident in the presence of one-tenth this molar concentration of guanidine.

DISCUSSION

It appears probable that the colored reaction products of cyanamide and ferrihemoglobin on the one hand and of guanidine and ferrihemoglobin on the other, while not identical have a similarity conditioned by that of their respective prosthetic groups. An actual similarity of these groups would be possible only on the assignment of the carbimid structure to cyanamide.

The manner in which ferrideheme formation potentiality governs the cholinergic activity of a compound is not clear though, with the exception of acetylcholine (which might, in vivo, assume a transitional resonant state) this feature is so common to cholinergic drugs that the property is difficult to regard as an artefact. It has been suggested that cholinesterase owes its enzymatic activity to a transitional element prosthetic nucleus.[13] This might explain the role of the acute polar tenaille in the anti-esterase cholinergics but it does not explain histamine, guanidine or pilocarpine activity unless it is assumed that the cell receptors, themselves, are also heme (or other transitional element prosthetic nucleus) conditioned. In this connection it is curious that those three amino-acids exclusively, which posses acute tenailles; arginine, histidine and cysteine, can block histamine action presumably by usurping its destined position in or on the receptor substance.[14] The formation of a ferrideheme by cysteine and the soluble iron-porphyrin derivative, lithium ferriheme[15] is shown by the comparative spectrophotometric curves in Fig. 5. In this case the determinant role of the acute polar tenaille (sulfhydryl) and the subsidiary role of general molecular species is further exemplified.

Whether or not the hypothesis, that polar covalent linkage in the juxtaperipheral orbit of a transitional element prosthetic nucleus, conditions cholinergic activity, should prove to be correct it will nevertheless have been a useful one. As a single example of this utility it may readily explain on a structural basis the verified histaminic effect of colloidal silica[16] which Habeeb[17] regards as the important pathodynamic feature of human silicosis. Any particle of colloidal silica, whether from quartz, cristobalite or tridymite is bound to have half of its presenting facets in the form of an acute tenaille composed of the electropositive silicyl ion. The latter is practically isomorphous with carbon monoxide (of definite cholinergic activity) and should have similar potentialities for ferrylheme formation.[18]

CONCLUSIONS

Guanidine reacts with ferrihemoglobin to form a pigment spectroscopically similar to cyanamide ferridehemoglobin. From this fact as well as from the

parallel cholinergic activities of cyanamide and guanidine the former is believed to have a carbimid structure.

The stereochemistry of cyanamide and certain other cholinergic substances is analyzed and it is postulated that cholinergic activity may be due to possession of an acute tenaille which may form a polar covalent linkage with the transitional element in the prosthetic nucleus of the cell receptor.

Colloidal silicon dioxide has a structure permitting combination with heme and it may be in this potentiality that the cholinergic effects of silica reside.

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A SYSTEMATIC STUDY OF THE MAIN ARTERIES IN THE REGION OF THE HEART. AVES XVI

Charadriiformes. Part 2[1]

FRED H. GLENNY

Further studies on the arteries in the neck and thorax of the Charadriiformes (9) were made possible by alcoholic specimens loaned to the writer by the United States National Museum and the Chicago Natural History Museum. The writer wishes to express his gratitude to Dr. Alexander Wetmore, Dr. Herbert Friedmann, and Mr. Dwight D. Davis for their help in making these materials available for study.

Twenty specimens, representing thirteen species, were dissected and diagrams of the arrangement of the arteries of the neck and thorax prepared.

MATERIAL[2]

Except where otherwise indicated, single specimens were dissected and diagrams of the arterial arrangement-patterns prepared.

Suborder Charadrii

Family *Jacanidae:*
Actophilornis africana (Gmelin) #291474 USNM
Hydrophasianus chirurgus (Scopoli) #19912 USNM
Jacana spinosa (L.) #61352 & #61489 USNM
Family *Rostratulidae:*
Rostratula benghalensis (L.) #100500 & #19577 USNM
Nycticryphes semicollaris (Vieillot) #227167 USNM
(*Rostratula semicollaris*) *Nycticryphes semicollaris* (Vieillot) #227601 USNM
Family *Haematopodidae:*
Haematopus o. ostralegus (L.) #292354 USNM
Family *Scolopacidae:*
Totanus [*Tringa*] *flavipes* (Gmelin) #106050 CNHM
Family *Recurvirostridae:*
Recurvirostra americana (Gmelin) #106062 CNHM
Family *Glareoloidae:*
Glareola maldivarum J. R. Forster #19574 & #20223 USNM
Family *Thinocoridae:*
Thinocorus rumicivorus Eschscholtz #227599 & #227977 USNM
Family *Chionididae:*
Chionis minor Hartlaub #70350 & #70351 USNM

Suborder Lari

Family *Laridae:*
Larus hyperboreus (Gunnerus) #97308 CNHM
Family *Rynchopidae:*
Rynchops n. nigra L. #320240 & #346680 USNM

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[1]Contributions from Blue Sea Lake Biological Laboratory, Messines, P. Q.

[2]Numbers refer to catalogue numbers of alcoholic specimens:
USNM = United States National Museum.
CNHM = Chicago Natural History Museum.

OBSERVATIONS

The basic ordinal arrangement-pattern for arteries in the neck and thorax of the Charadriiformes appears to be fairly consistent, and is as follows: bicarotidinae normales; ligamentum aortae persistent; ligamentum botalli (right) variable; subclavian series (medial to lateral)—*coracoid major*, with sternotracheal branch normal, *axillary*, *intercostal* (single or bifurcated), and two *pectoral* arteries; syringo-tracheal arteries usually arise as branches of the *ducti shawi* which in turn are usually produced as derivatives of the common carotid arteries *a priori* origin of the superficial cervical and internal carotid (trunk) arteries. Rarely the ductus shawi may arise as a branch of the cervico-vertebral or superficial cervical arteries. The thyroid glands are supplied by short branches from the central or lateral face of the common carotids near the normal origin of the ductus shawi.

Presence of an accessory oesophageal artery (9, Fig. 1) is variable as previously indicated. Retention or persistence of the right ligamentum botalli varies among the species within a family, and the rate of atrophy may likewise be a variable factor (3, 4, & 6). In some of the species, it appears that this vestigeal structure tends to fuse with the ventral face of the right radix aortae and, as a result, tends to lose its individual identity as a separate structure in the adult.

It is likewise true that further progressive atrophy may occur in the case of the vestigeal left ligamentum aortae. This structure, however, tends to become intimately associated with the connective tissue of the pleural cavity. It should be noted that atrophy of the ligamentum aortae may proceed at a rate entirely independent from that of the ligamentum botalli, and that while the right ligamentum botalli may be completely atrophied or fused to the functional radix aortae, the ligamentum aortae may persist as a very prominent vestige. On the other hand, in several forms already studied, there are several instances in which a relatively small or greatly reduced ligamentum botalli was observed along with a very small, much reduced ligamentum aortae.

Jacanidae: In *Actophilornis africanus*, *Hydrophasianus chirurgus*, and *Jacana spinosa* the ductus shawi arises from the common carotid artery, but in *Hydrophasianus* the accessory oesophageal artery appears to arise from the left ductus shawi near its origin from the common carotid, while in both *Actophilornis* and *Jacana* this vessel has an independent origin from the common carotid near the point of origin of the superficial cervicals. Vertebral and lateral superficial cervical arteries usually have a common origin (cervico-vertebral) from the common carotid in both *Actophilornis* and *Hydrophasianus*, while both of these vessels have separate points of origin in *Jacana*.

In each of these three species, the ligamentum aortae is present, but much reduced; the ligamentum botalli fuses with the functional radix aortae and persists only as a very fine white line on the ventral face of the radix. The subscapular arteries arise as branches of the superficial cervical arteries.

In *Actophilornis* there is an extreme dorso-lateral displacement of both the trachea and oesophagus. The lower two-thirds of the trachea is laterally displaced with the oesophagus. In *Hydrophasianus* there is only a slight lateral displacement of the trachea.

Rostratulidae: The ligamentum aortae is large and prominent in both *Rostratula benghalensis* and *Nycticryphes semicollaris;* the ligamentum botalli is usually completely atrophied in the adult of *Rostratula* and remains as a thin, incomplete ligament in *Nycticryphes*. The ductus shawi follows the normal ordinal pattern, while an accessory oesophageal artery from the left side appears to be lacking, or is at least much reduced, in both species.

In *Rostratula* the vertebral and superficial cervical arteries arise separately from the common carotid, while in *Nycticryphes* at least a short cervico-vertebral artery arises from the common carotid. After running a very short course, the

cervico-vertebral artery divides to form the vertebral and superficial cervical arteries. The right superficial cervical artery of *Rostratula* appears to bifurcate into lateral and ventral branches which afford a better distribution of blood to the oesophagus.

The trachea is somewhat laterally displaced in both *Rostratula* and *Nycticryphes;* this is accompanied by a somewhat dorso-lateral displacement of the oesophagus.

Details in the arrangement-pattern of USNM specimens #227601 and #227167 are identical and should be assigned to *Nycticryphes semicollaris.*

Haematopodidae: Arteries of the lower cervical region of *Haematopus o. ostralegus* are well-developed and serve to afford considerable blood supply to the tissues of the neck, including the oesophagus. Origin of the ductus shawi is normal; the accessory oesophageal artery arises as a branch of the left ductus shawi near the point of origin of the latter from the common carotid artery. The cervico-vertebral artery sends off the ventral superficial cervical and vertebral arteries before forming the scapulo-cervical which gives rise to the subscapular artery and then passes anteriorly as the lateral superficial cervical artery. The right ventral superficial cervical serves as the primary ascending oesophageal artery. The lateral superficial cervicals are comparable to the *comes nervi vagi* of Beddard and others.

The ligamentum aortae is a large prominent vestige which may retain its connection with the pulmonary artery as does the smaller ligamentum botalli of the right side.

The carina is deep, and on it are produced well-developed pectoral muscles.

Scolopacidae: The arrangement of arteries in *Totanus flavipes* is quite similar to that in *Oxyechus v. vociferus* (9, Fig. 1), but there are certain minor differences in details.

The vertebral and superficial cervical arteries usually arise separately, but in the same region, from the common carotid, and do not appear to unite to form a cervico-vertebral artery. In individual cases, however, this might occur due largely to the close association of these two vessels. The accessory oesophageal artery arises as a branch of the left superficial cervical artery, and the subscapular arteries arise as branches of the cervicals.

In *Totanus flavipes,* the ligamentum aortae is a much reduced and very thin ligamentous vestige, while the ligamentum botalli is entirely obliterated in the adult.

Both the oesophagus and the trachea are dextro-laterally displaced in *Totanus* along the major length of the neck.

Recurvirostridae: Recurvirostra americana is interesting for its several minor differences in arrangement-pattern. The ductus shawi and syringo-tracheal arteries arise not directly from the common carotid but from the cervico-vertebral arteries which give rise to the vertebral, subscapular, and superficial cervical arteries at a common point of origin. The superficial cervical arteries further divide into ventral and lateral vessels. The main oesophageal and tracheal blood supply is afforded by the cervical arteries of the right side. The intercostal arteries bifurcate into lateral and dorso-lateral branches. The ligamentum aortae remains as a significantly prominent vestige, while the basal or distal portion of the ligamentum botalli is readily visable, tapering to a very thin white ligament at its proximal end.

There is a dextro-lateral displacement of the oesophagus and trachea in *Recurvirostra.*

Glareolidae: Glareola maldivarum is similar to *Nycticryphes semicollaris* in arrangement, except that an accessory oesophageal artery is present, and this vessel arises as a branch of the left common carotid artery. The cervical and vertebral arteries form a common vessel to join the common carotid. A small

ventro-lateral cervical artery may be present, in addition to the normal superficial cervical artery, on the right side. The ligamentum aortae is reasonably large and prominent, while the ligamentum botalli is so greatly reduced as to be almost completely obliterated.

Thinocoridae: Thinocorus rumicivorus is simple in arrangement, but shows some variation in point of origin of the vertebral and cervical arteries. Generally, however, it would appear that the vertebral and cervical arteries tend to arise separately from the common carotids, although they may occasionally join to form a common vessel. The accessory oesophageal artery arises as a branch of the left superficial cervical artery.

In the above respects, *Thinocorus* closely resembles *Totanus flavipes*. The thyroid arteries arise as short branches of the left and right superficial cervical arteries. The ligamentum aortae is prominent, but the ligamentum botalli is entirely lacking.

Chionidae: Both the ligamentum aortae and ligamentum botalli are present and prominent in *Chionis minor*. The intercostals arise more laterally in *Chionis* and appear to branch from the base of the posterior pectoral artery.

The right common carotid gives rise to the ascending oesophageal artery which sends off the thyroid arteries, the lateral superficial cervical artery which gives off the subscapular artery, the vertebral artery, and finally the internal carotid (trunk) artery. The left common carotid produces a cervico-oesophageal artery which then divides to form the left superficial cervical artery from which the left subscapular arises as a branch as does the accessory oesophageal artery which sends off small branches to the thyroid gland, a vertebral artery, and finally the left internal carotid (trunk) artery. The left vertebral artery was observed to send off cervical segmental arteries.

Laridae: Larus hyperboreus is similar in basic arrangement to *L. argentatus* (9, Fig. 2). Minor differences appear, however, in the origin of the verterbal arteries (these may join with the superficial cervicals to form a common vessel or they may arise separately from the common carotids), and in the presence of an accessory oesophageal artery which arises as a branch of the left accessory superficial cervical artery. Both accessory cervical arteries send off small branches to the ventral collis before giving rise to several small vessels along their course along the ventro-lateral cervical region. The right accessory cervical vessel appears to function as an ascending oesophageal artery.

Both the ligamentum aortae and ligamentum botalli are quite prominent vestiges and appear to maintain their embryonic attachments.

Rynchopidae: Rynchops n. nigra is similar in arrangement to *Hydrophasianus chirurgus* except that the accessory oesophageal artery arises separately from the common carotid near the point of origin of the cervico-vertebral artery. The right superficial cervical artery serves as the primary ascending oesophageal artery.

The ligamentum aortae is prominent distally but becomes quite thin proximally. The ligamentum botalli is very much reduced along its entire length.

Both the oesophagus and trachea of *Rynchops* are dextrolaterally displaced with the result that the trachea does not lie along the ventral medial cervical line as is the case with most orders of birds.

DISCUSSION

It may be seen from the above observations that within both the families and species, herein represented, there are minor differences in the arrangement-pattern of cervical arteries, along with differences in the degree of atrophy of both the ligamentum aortae and ligamentum botalli. Such differences may be accounted for on the basis of specific phylogenetic divergences. The group included in this study exhibited a relatively narrow range of variation, however, and it will be

noted that the essential differences result from various combinations in origin of the vertebral, cervical, and accessory oesophageal arteries.

It is of especial interest to note that the basic ordinal arrangement-pattern is constant, and that it shows close similarity to the basic arrangement-patterns of Anseriformes (5), Ciconiiformes (7), and Gaviiformes (8). Greater variation in the origin of the thoracic vessels, along with wider range in arterial arrangement in the cervical region, is found in several other orders of *aves bicarotidinae normales*.

Observations *a propos* variability in degree of retention of the ligamentum aortae and ligamentum botalli might lead one to believe that certain unknown factors of growth and development are involved in the various rates of atrophy as well as levels of atrophic degeneration. Since atrophy of several of these embryonic vestiges appears to operate on gradient levels—from left to right—factors involved in control of rates of atrophy might be referred to as *Atrophic Gradient Factors*. These factors appear to operate in conjunction with, but somewhat independent of, each other under normal conditions, and may account for some differences in retention of certain embryonic vestiges among several species within a family or order of birds.

It is not inconceivable that each structure which has definite embryonic functions and which subsequently becomes morphologically and functionally altered may have growth or developmental factors controlling rates and extent of structural and functional modification along with factors responsible for initiation of a chain of events ultimately resulting in the adult condition. It is evident that these initiating and gradient factors do not always function properly. Results of such malfunctioning have been observed in several instances (1, 2, 3).

SUMMARY

Thirteen species of Charadriiformes, representing ten families, were dissected, and diagrams of the arterial arrangement-patterns prepared. An uncomplicated basic ordinal arrangement of thoracic and cervical arteries was observed. Some minor individual or family differences were observed and noted. The range of differences was limited, and tended to lie within the range of normal ordinal phyletic deviation. It would appear that the Charadriiformes show a fairly stable ordinal arterial arrangement, not always observed in various orders of birds.

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ANNUAL REPORT OF THE OHIO ACADEMY OF SCIENCE

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REPORT OF THE FIFTY-SEVENTH ANNUAL MEETING OF THE OHIO ACADEMY OF SCIENCE

The Academy was privileged to participate in the year-long activities in the celebration of the seventy-fifth anniversary of The University of Toledo by holding the annual meeting on the campus on May 6, 7, and 8. Excellent arrangements had been made by the Local Committee, with Dr. A. N. Solberg as chairman, attendance was good and programs were presented by all sections of the Academy.

The meeting opened with the Executive Committee and Council meetings on May 6, and sectional meetings were held on May 7 and 8. The annual banquet was held at the Secor Hotel on Friday evening at 6:30. Dr. A. N. Solberg served as an able toastmaster. A brief and interesting history of the University of Toledo was presented by Dr. Frank Hickerson. Greetings were extended by President W. W. White of the University of Toledo, and response was given for the Academy by Dr. F. S. Howlett. The presidential address was given by Dr. A. W. Lindsey on the subject, "The Fallacy of Communism."

Dr. F. H. Krecker presented a report on the organization and activities of the new reactivated section formerly known as the Junior Academy and now known as the Science Education section.

The annual report of the secretary was presented and carried an analysis of the membership of the Academy at present and the announcement of the election of the following members as fellows:

Clarence F. Clark	Wendell R. Koch	W. R. Pyle
Floyd B. Chapman	Harry V. Knorr	Hallock F. Raupp
John W. Coulter	Howard K. Justice	H. H. Roseberry
Charles M. Diserens	Arthur L. Lutz	James M. Spuhler
Frank M. Fletcher, Jr.	O. E. McClure	J. Fisher Stanfield
Earl L. Green	Harold E. Newhard	Will S. Thompson
Fred H. Householder	T. D. Phillips	Clarence W. Wallace

The report of the Nominating Committee was presented by Dr. W. C. Beaver, of the Necrology Committee by Dr. J. E. Carman, and of the Resolutions Committee by Dr. W. C. Kraatz.

Respectfully submitted,

Rush Elliott, *Secretary.*

REPORT OF THE EXECUTIVE COMMITTEE AND COUNCIL

The Executive Committee met on January 16, and again on May 6, and the Council on January 17, and again on May 6.

A petition was received from a group of new members of the Academy for the recognition of a section of the Academy to be known as the Science Education section, to be Section J, and to replace the former Junior Academy Section. This will be made up chiefly of high school science teachers. Petition was approved.

A special committee was appointed (R. L. Edwards, chairman, F. H. Krecker, G. W. Blaydes, W. M. Tidd and James Vaughn) to make a study of the allocation of funds collected as annual membership dues and to report at the next winter meeting of the Council.

The Membership Committee reported 140 new members. This brings the total membership to more than 850, the largest in the history of the Academy. The applicants were duly accepted. Nominations for Fellowship were presented and approved (see report of Annual Meeting).

The appointment of Miss Lillian Michaelis of The Ohio State University as Librarian of the Academy was approved.

A proposal by the secretary for a regular plan for the location of the annual meeting on a geographical basis was adopted. This is in effect that every other year the meeting should be held at an institution in the central part of the state and on alternate years in the four quarters in a rotary plan.

Invitations for the 1949 meeting were received from Miami University and Denison University and for the 1950 meeting from Capital University as a part of the Centennial program. The invitations from Miami, from which an invitation for the 1948 meeting had also been received, and from Capital were accepted and the invitation from Denison will again be extended for a later date. The 1949 meeting will have to be set for an earlier date than the early part of May, to which we have been accustomed in the past several years.

Respectfully submitted,

Rush Elliott, *Secretary.*

REPORT OF THE TREASURER

COLUMBUS, OHIO, August 10, 1948.

To the Ohio Academy of Science:

I submit herewith a financial statement of the condition of the Ohio Academy of Science as of December 31, 1947. The books have been audited and the opinion of the auditor is herewith attached.

Respectfully submitted,

WILBUR M. TIDD, *Treasurer.*

OHIO ACADEMY OF SCIENCE BALANCE SHEET

As at December 31, 1947

ASSETS

CURRENT EXPENSE FUND:		
Cash in Bank		$ 540.13
Bonds owned:		
U. S. War Savings Bonds Series F (cost)	$ 111.00	
U. S. War Savings Bonds Series G (cost)	1,900.00	
Total Bonds Owned		2,011.00
Total Assets—Current Expense Fund		$2,551.13
RESEARCH FUND:		
Cash in Bank	$ 247.31	
Banc-Ohio Securities Stock	437.50	
Bonds owned:		
Fort Hayes Hotel, Columbus, Ohio (cost)	1,300.00	
U. S. War Savings Bonds, Series G (cost)	300.00	
Total Assets—Research Fund		2,284.81
Total Assets		$4,835.94

LIABILITIES AND NET WORTH

CURRENT EXPENSE FUND:		
Liabilities—		
Accounts payable		$ 15.00
Deferred Credits—		
1948 Dues collected in 1947		57.50
Total Liabilities and Deferred Credits		$ 72.50
NET WORTH:		
Ohio Academy of Science—		
Current Expense Fund	$2,478.63	
Research Fund	2,284.81	
Total Net Worth		4,763.44
Total Liabilities and Net Worth		$4,835.94

OHIO ACADEMY OF SCIENCE STATEMENT OF INCOME AND EXPENSE

For the Year Ended December 31, 1947

INCOME:	
Dues from Members	$1,775.00
Grants for Research	307.00
Sale of Publications	61.26
Interest on Bonds	41.25
Total Income	$2,184.51

OPERATING EXPENSES:		
Subscriptions—Ohio Journal of Science	$1,026.00	
Printing Proceedings, 1947	240.70	
Printing—Other	304.45	
Research Grants	307.00	
Postage and Office Expense	172.13	
Secretary's Honorarium	100.00	
Binding Reports	13.14	
Miscellaneous	3.10	
Total Operating Expense	$2,166.52	
NON-OPERATING EXPENSE:		
Ohio Journal of Science—special grant	99.00	
Total Expenses		2,265.52
Excess of Expense Over Income		$ 81.01

AUDITOR'S CERTIFICATE

COLUMBUS, OHIO, July 1, 1948.

To the Ohio Academy of Science, Columbus, Ohio.

GENTLEMEN:

In accordance with your instructions, I have examined the accounts and records of the Ohio Academy of Science for the year ended December 31, 1947.

A detailed audit was made of all transactions handled by the treasurer. Cash in bank was verified by bank certification. Securities in safety deposit box were verified by personal examination. My examination was made in accordance with generally accepted auditing standards.

In my opinion the accompanying balance sheet and the statement of income and expense (cash basis) fairly presents the financial position at December 31, 1947, and the results of operations on a cash basis for the year ending December 31, 1947. These statements are in conformity with generally accepted accounting principles.

Respectfully yours,

D. M. SHONTING,
Certified Public Accountant.

REPORT OF THE TRUSTEES OF THE RESEARCH FUND

Your trustees beg to report for the year 1947-48 that the grant to Doctor E. Lucy Braun has been completed. Her grant, as stated in a previous report, was prior to her appointment as a member of the Board. Also, a grant for $31.50 was made to R. D. Wood for an article with illustrations on the Caraceae of Put-in-Bay, published in the *Ohio Journal of Science*.

We have also made a grant to Doctor Margaret Fulford of the University of Cincinnati in the amount of $153.00, which amount has been received from the A. A. A. S. and is to assist her in her studies of Hepaticae.

The statement by Doctor Tidd as Treasurer will contain details of the assets and funds available for grants from the Research Fund of the Academy.

There is a probable annual grant to come from the A. A. A. S. for the present year which will be about $150.00. There will also be some available funds as a balance in the Academy Research Fund and it is desirable that applications for assistance be made promptly. This is especially true for the grant from the A. A. A. S. which is available during the year. Applications for assistance should be made to the Research Fund, Ohio Academy of Science, Herbert Osborn, Chairman, B. & Z. Building, Ohio State University, Columbus 10, Ohio.

Respectfully submitted,

E. LUCY BRAUN,
J. ERNEST CARMAN,
HERBERT OSBORN, *Chairman.*

REPORT OF THE LIBRARY COMMITTEE

The library has indeed felt the absence of Mrs. Miller's capable hand, but has carried on after a fashion which we hope will show constant improvement.

Back issues of the Ohio Journal of Science to cover the war years, have been sent through

the Smithsonian Institution to seven foreign countries. Four new exchanges have been added. Lacks have been filled on request.

The report of the sales of publications handled by the library is incorporated in the report of the Academy Treasurer.

Respectfully submitted,

LILLIAN MICHAELIS.

REPORT OF THE JOINT ADMINISTRATIVE BOARD OF THE OHIO JOURNAL OF SCIENCE

The annual meeting of the Joint Administrative Board of the Ohio Journal of Science was held at Columbus, Ohio, April 10, 1948. Dr. Blaydes, having called the meeting of the board, presided at its organization. Present were Drs. Spieker and Meyer, representing the Ohio State University; Drs. Hefner and Anderson, representing the Ohio Academy of Science, and Drs. Blaydes and Miller, representing the Ohio Journal of Science. Upon a motion by Dr. Meyer and seconded by Dr. Hefner, Dr. Spieker was elected to serve as Chairman of the Board. Dr. Miller continued to serve as secretary.

The minutes of the preceding meeting were read and approved.

The chair called for a report of the Business Manager. Dr. Miller's report was in the form of a financial statement for Volume 47 of the Journal, a copy of which is herewith attached. Dr. Anderson moved the acceptance of the financial report, the motion was seconded by Dr. Hefner and passed by the board.

Dr. Miller, in commenting upon the financial position of the Journal, called the attention of the board to the gain in assets of $281.87 for Volume 47, over Volume 46. He explained that this was due to a combination of favorable factors, the failure of any one would have caused a deficit in the current operating expense. The Ohio Academy, for example, paid into the Journal for pro-rata dues $273.00 more during 1947 than in 1946. The number of pages of the Journal was reduced and a number of special papers and author's payment of publication costs were obtained, thus further effecting an economy of publication.

The increase in Academy memberships and the restoration of foreign exchanges and subscriptions has necessitated an increase in the number of copies of the Journal to be printed in the future. This will add to the present cost of publication.

Upon the suggestions of the Business Manager, Dr. Hefner moved and Dr. Meyer seconded a motion to authorize the Business Manager to devise, in cooperation with Dr. Tidd, of the Academy, a symbol to be placed on the stencil of all those receiving the Journal. Motion carried.

The chairman then called for the report of the Editor. Dr. Blaydes then presented a review of papers presented in Volume 47. He called attention to the variety of papers in this volume, 10 science divisions being represented through 41 papers, totaling 265 pages. Eight book reviews were also published. The editor called the attention of the board to the limited number of papers on hand and wished to make known to this body that early publication in the Journal is possible. Dr. Hefner moved the acceptance of the Editor's report, seconded by Dr. Anderson. Passed by the Board.

The Chairman then called for an election of Business Manager, and Editor for Volume 48.

Dr. Hefner moved the appointment of Dr. Miller as Business Manager, seconded by Dr. Meyer. Passed by the Board.

Dr. Meyer moved the appointment of Dr. Blaydes as Editor, seconded by Dr. Hefner. Passed by the Board.

Dr. Hefner moved that the Auditing Committee be composed of Dr. Meyer and Dr. Spieker, seconded by Dr. Anderson. Passed by the Board.

Under new business, it was the expression of the Board that means should be used to stimulate papers from all sections of the Academy. The Secretary was directed to include in the report to the Academy an appeal to the Vice-Presidents of each section to encourage their section affiliates to offer papers in the Journal. The Journal can print only those papers that are submitted, and if section members are disappointed in the offerings in the Journal from their field, it is because they do not offer for publication in the Journal their own researches.

As informal discussion regarding the forthcoming consideration on the part of a committee to study Academy membership without the Journal followed. It was agreed that the Journal cooperate with the Junior Academy and other interested groups in making available space in the Journal for articles of interest to such groups.

There being no further business to come before the Board at this time, it was adjourned.

Respectfully submitted,

JOHN A. MILLER,
Secretary of the Board.

THE OHIO JOURNAL OF SCIENCE

Fiscal Year 1947

RECEIPTS

Balance from 1946	$ 251.65
University allowance	1,000.00
Ohio Academy of Science—pro rata of dues	1,033.50
Ohio Academy of Science—proceedings	240.70
Ohio Academy of Science—delinquent payment	68.75
Subscriptions	140.00
Sale of back numbers	52.09
Author's payment for plates	167.70
Payments by authors and institutions of publication costs	617.66
	$3,572.05

EXPENDITURES

Spahr and Glenn, Printing—Vol. 47 and envelopes and stationery	$2,565.14
Bucher Engraving Company	367.85
Postmaster	85.11
Bank Charges	1.43
Clerical assistance	19.00
	$3,038.53
Balance on hand, February 20, 1948 (Huntington National Bank)	533.52
	$3,572.05

REPORT OF THE COMMITTEE ON CONSERVATION

The report of your Conservation committee, which is herewith respectfully submitted, is based upon the universally recognized concept that all activities designed to conserve our natural resources should be founded on and guided by a scientific understanding of those natural resources. Our recommendations also have considered the fact that, since all the affairs of mankind are greatly dependent upon the richness, abundance and availability of natural resources, it becomes the civic duty of every citizen to take an active part in the program of conservation, contributing specially those skills and understandings which form a part of his personal vocation. Upon both these counts, the members of the Ohio Academy of Science have a special opportunity and upon them devolves a special duty to take an active part in the public program of conservation.

In the field of research, whether involving the physical, biological or social sciences, the members of the Ohio Academy of Science possess sound and proven data that would be valuable guidance to conservation technicians, and also to legislators and administrators of those agencies which plan and execute conservation programs. All this is equally true of those members engaged in field work, such as ecological surveys. Your committee recommends that the Academy as a whole and as individual members shall here resolve that such scientific data shall not only be made readily available but that it shall become a part of the public conservation program through vigorous personal participation in that program.

The success of any public program is very largely determined by public opinion, which profoundly affects both legislation and public behavior—the future of conservation is largely a matter of public opinion. The members of the Ohio Academy of Science occupy a position that provides an outstanding opportunity to promote proper understandings concerning conservation through education. Many members have daily contact with large numbers of our future citizens in the classroom and have countless opportunities to use scientific facts to drive home the social importance of conservation of our natural resources. Your committee recognizes that the prime purpose of teaching is not to fill heads with knowledge—it is to guide hands and feet into a pattern of behavior that will enable students to live better with each other and with their world in every day life.

The teacher should remember that his position causes his opinions to be greatly respected in the community in which he lives. It is his duty as well as his privilege to mould the opinion and guide the behavior of his community. In meetings of civic groups and in the columns of local newspapers, the Academy member can do much to influence community thought and action in matters of conservation. Your committee recommends that members of the Academy seek and accept opportunities to render this kind of community service.

Another field of conservation education lies in the boys and girls of our public schools. In this connection, attention is called to the new section of the Academy for public school teachers. As a part of their activities, this new section will develop and guide the Junior Academy of Science, whose membership will be composed of boys and girls of the public schools. The value of this section and of the Junior Academy of Science to all that the Ohio Academy of

Science stands for and its value to conservation is apparent. Your committee strongly recommends that the Academy shall give the new section a cordial welcome and that individual members shall give it active assistance.

Respectfully submitted,

CLARENCE TAFT,
E. W. E. SCHEAR,
R. V. BANGHAM,
C. L. DOW,
R. W. FRANKS,
GUY CONREY,
A. R. HARPER, *Chairman.*

REPORT OF THE COMMITTEE ON NECROLOGY

The Committee on Necrology reports with deep regret the death of six members of the Academy since the last annual meeting. The following memorial statements were written by colleagues of the deceased members as indicated by the name following each statement.

Respectfully submitted,

E. G. DETWEILER,
H. R. EGGLESTON,
J. ERNEST CARMAN, *Chairman.*

GUY WOOLARD CONREY

Guy Woolard Conrey, Professor of Agronomy, Ohio State University, died at his home April 20, 1948. He was born in Northboro, Iowa, December 10, 1887. Surviving are his wife and two daughters.

Dr. Conrey received the B.A. and M.A. degrees from the University of Michigan in 1908 and 1909, respectively, and the Ph.D. degree at the Ohio State University in 1921. Dr. Conrey served as Assistant in the Division of Soils of the Wisconsin Geological and Natural History Survey from 1909 to 1917. He came to Ohio in 1917 as Instructor in soils, and Assistant in Soil Survey, was placed in charge of the Soil Survey in Ohio in 1925, and was progressively promoted to Professor of Agronomy at Ohio State University and Associate Agronomist of the Ohio Agricultural Experiment Station.

Dr. Conrey was a fellow of the Ohio Academy of Science and the American Society of Agronomy. He was a member of the Soil Science Society of America, the American Association for the Advancement of Science, the American Geographic Association, the American Forestry Society, the Geophysical Union, and the International Society of Soil Science. His interest and activity in his profession is evidenced through his several chairmanships and committee assignments that he held in these societies. He was also a member of Sigma Xi, Phi Lambda Upsilon and Gamma Sigma Delta honorary societies.

Dr. Conrey's principal interest was in the field of soil science; specifically, soil morphology classification, technology and land use. He was also intensely interested in geology, mineralogy, and geography, subjects that are closely linked with soil science and his studies have tended to clarify many of the interrelationships of these fields. With a broad concept of the factors involved, Dr. Conrey and his associates have contributed very materially to our present concepts of soil development and classification. Further, his work in the relationships of soil characteristics, soil productivity, and soil management has led to greater practical application of soil research results.

Dr. Conrey was an inspiring teacher, both in the classroom and in the field. His thorough understanding of the field of soils, and its relationship to other sciences, together with his kindly nature and ability to explain complex relationships in simple language, insured his popularity as a lecturer. His courses were among the most popular in the college. His activity in the fields of geology, geography, and economics gave him a rare insight into the field of soils that was reflected in his teaching as well as his research activities.

Although his health was impaired, Dr. Conrey assumed extra duties directly concerned with the war effort in 1941. In addition to his already heavy load of work, he taught courses in A.S.T.P. and applied his soils knowledge in locating airfield, manufacturing and war materials storage sites. Even after a severe stroke in 1944, from which he never fully recovered, he contributed a great deal through conferences, correspondence, and his writings.

—*D. D. Mason and D. R. Dood.*

JOHN SCOTT GILLESPIE

Mr. J. S. Gillespie, a member of the Academy for 22 years, died at his home in Columbus on August 31, 1947. Mrs. Gillespie had preceded him by about ten years.

Mr. Gillespie was a geologist who had been on the staff of the Ohio Fuel Gas Company from 1918 until retired from active service in 1936. He was born on February 22, 1864, on a farm near Washington C. H., Ohio. After finishing school he took employment with the D. T. & I.

Railway at Waverly, where he learned telegraphy and had his first experience in railroad operation. This career he followed for a number of years, holding the position of division superintendent of the B. & O. at Newark and at Zanesville. Later he held important posts with several western roads, his work finally taking him to Spokane, Washington, where he was so impressed with the future of the Northwest that he went into promotional work and served as secretary of the Spokane Chamber of Commerce for a time.

From early youth Mr. Gillespie was greatly interested in geology. His work and travel so intensified that interest that his avocation finally became his full-time occupation. His geological training was almost entirely through reading, experience, and observation, but it was sound training, as those who knew him will testify.

John Scott Gillespie was one of those rare individuals who seemed younger than his years because of his abounding curiosity, and particularly because of his great interest in scientific investigation. His many friends remember him as a gentle man of penetrating insight, of kindly wit, and of unwavering loyalty.—*K. C. Cottingham.*

John Samuel Houser

John Samuel Houser was born April 19, 1881, on a farm near Oxford, Kansas. He graduated from high school in Oxford and then entered Kansas State Agricultural College where he became interested in the subject of entomology. He was graduated with the class of 1904 and immediately went to work in the Department of Entomology at the Ohio Agricultural Experiment Station. In 1907 he was granted a two-year leave from the Ohio Station to carry on entomological work in Cuba—working at the Estacion Experimental Agronomica at Santiago de Las Vegas. He returned to the Ohio Experiment Station as an associate in 1909. In 1926, Mr. Houser became chief of the Department of Entomology, which position he occupied at the time of his death. He received the M.S. degree from Cornell University in 1911, and the honorary degree of Doctor of Science from his alma mater, Kansas State Agricultural College, in 1944.

Dr. Houser's chief interest was in the field of forest insects. He loved to camp in the State Forests, to roam the hills studying trees and insects. He was the first entomologist to use the airplane to disperse insecticides—the test being directed against the catalpa hornworm which was devastating a grove in Miami County, Ohio, in the summer of 1921. He was a charter member of the Entomological Society of America, a member of the American Association for the Advancement of Science, Past President of the American Association of Economic Entomologists, and a Fellow of the Ohio Academy of Science.

Dr. Houser was the author of many scientific and popular entomological papers. His best known publication is the Ohio Experiment Station Bulletin entitled: "Shade and Forest Tree Insects" which, though published nearly thirty years ago is still used by working entomologists.

Dr. Houser died suddenly on the night of June 25, 1947, from the effect of a recurring heart attack from which he had been suffering for about two years. His wife, Elizabeth, died in 1941. He is survived by two married daughters; by a brother and a sister, each living in Kansas.—*T. H. Parks.*

Raymond Jesse Seymour

The death of Professor Emeritus Raymond Jesse Seymour which occurred on April 10, 1948, brought to a close the career of a man who had spent 45 years in faithful and distinguished service to the College of Medicine and the Ohio State University.

Dr. Seymour was born in Groveport, Ohio, in 1878. He received the Bachelor of Science Degree from the Ohio State University in 1900, the Degree Master of Science from Tufts College in 1901, and the Degree Doctor of Medicine from the Ohio Medical University in 1903. He began his career as a teacher in 1903 when he was appointed an assistant in the Department of Pathology. He joined the staff of the Physiology Department in 1905, and served this department continuously until his death. He was given the rank of Professor of Physiology in 1928 and served for seven years as Chairman of the Department. Dr. Seymour was particularly gifted as a teacher of beginning students and was unexcelled in the clear, concise, and simple exposition of the fundamental concepts of physiology. Thousands of students have profited from their associations with him. His broad background of preparation and his fine personality made him a leader among his colleagues and a wise councillor and guide of students. In 1944, poor health forced him to give up active teaching and he was given the rank of Emeritus Professor. However, even after his retirement, he maintained his active interest in the Department, and was always ready to offer his advice and council in matters of administration.

For many years Dr. Seymour was an active and enthusiastic member of the Ohio Academy of Science. From 1920 to 1922 he served as Vice-President of the Academy and Chairman of the Medical Science Section. His council and advice will be sorely missed, and the Ohio Academy of Science wishes to record their sincere appreciation of Dr. Seymour's long and distinguished services and to express their profound sorrow at his passing.—*F. A. Hitchcock.*

Julius F. Stone

Julius F. Stone was a successful banker and industrialist but he was quite at home wherever the language of science was spoken. He was a distinguished explorer in his own right and an amateur astronomer of note. He was so impressed by the importance of biology that he gave Gibralter Island, long the summer home of Jay Cooke, the Civil War banker, to the Ohio State University as the site for its year-round marine biological laboratory. He was a prime mover in the University's Research Foundation which he served as president. He was the modest and often anonymous donor of scientific apparatus and equipment to the University—notably its cyclotron. During his long years of service on the University Board of Trustees he was always mindful of the scientific and technical departments. As evidence of his own standing as a man of science, he was a fellow of the American Geographical Society and of the Royal Astronomical Society. He also held membership in the American Astronomical Society, in the American Society of Mechanical Engineers, and in the exclusive Explorers' Club, of New York. He made the first organized boat trip with a party through the entire course of the Colorado River. The story of this trip was told in his Canyon Country, published in 1932. He was a master of the English language—spoken or written,— a rare companion, a man whose interests were as broad as all human experience. The cause of science, and particularly of scientific research, lost a devoted follower when he died in 1947.—*James E. Pollard.*

Lewis Gardner Westgate

By the death of Dr. Lewis G. Westgate, March 30, 1948, at Delaware, Ohio lost a discerning student of local geology, the nation one of its most adept teachers, and the college world one of its most skillful educators. Dr. Westgate in many respects was a unique personality, although outwardly scarcely different from other scholars. Much interested in the interpretation of geology in the field, he was first and foremost interested in developing the scholarly and scientific potentialities of college students. He was intolerant of sham and subterfuge, either by students or men in private or public activities. The student who tried to "get by" in his classes soon learned, often to his discomfiture, what education really meant.

He was widely read, scholarly, and an independent and precise thinker. His formula for teaching might be stated in two words: What? Why? His type of humor, at times rather puchish, and inciseveness of speech, coupled with pertinent illustrations from the current scene, made his chapel talks long remembered.

Dr. Westgate was born in 1868 in Phenix, R. I. His B.A. degree was obtained at "Old" Wesleyan in 1890; his M.A. from Harvard in 1892, and his Ph.D. there in 1896. At Wesleyan he was under the influence of renowned men, including William North Rice. At Harvard he became more or less a disciple of William Morris Davis, famed geographer and geomorphologist. His first teaching was in the public schools at Evanston, Ill. After several years there he came to Ohio Wesleyan University in 1900 as Professor of Geology. Here he served for the remainder of his life.

He was a Fellow of the Geological Society of America and a member of other scientific societies. He was president of the Ohio Academy of Science in 1910.

His main contribution to the geology of Ohio was the "Geology of Delaware County," published in 1926 as Bulletin 30 of the Geological Survey of Ohio. Numerous papers on various phases of geology were published in technical periodicals and as reports of the U. S. Geological Survey. Articles expressing some of his views on education and the philosophy of living appeared from time to time elsewhere. Several summers were spent in field work for the United States Geological Survey in Alaska and in the western states.—*Arthur Bevan.*

REPORT OF COMMITTEE ON RESOLUTIONS

Be it Resolved, that the members of the Ohio Academy of Science express to the administration of the University of Toledo, and to the Local Committee under the able leadership of Dr. A. N. Solberg, its appreciation of the hospitality so freely extended and the excellent facilities furnished, which have made this, our fifty-seventh annual meeting, so pleasant and successful.

Be it further Resolved, that the Ohio Academy of Science express to President Wilbur W. White and the faculty of the University of Toledo, its felicitations on the achievement of the seventy-fifth anniversary of this notable institution of learning.

Respectfully submitted,

W. C. Kraatz,
P. B. Sears,
N. Mogendorff, *Chairman.*